AMCD QUALITY ASSURANCE PROJECT PLAN

EPA United States Environmental Protection Agency

Office of Research and Development
Center for Environmental Measurement & Modeling
Air Methods & Characterization Division
Combustion Source Branch

Characterization of PFAS Air Emissions from Fabric Thermal Application Processes

Method Development/Measurements
QA Category A

Intramural Research

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ORD National Program:
A&E

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AMCD
Quality Assurance Project Plan (QAPP)

Title:	Characterization of PFAS Air Emissions from Fabric Thermal Application Processes
Division/Staff:	AMCD\CSB
QA Category:	A
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List of Abbreviations

ACAB	Atmospheric Chemistry and Aerosol Branch
ADQ	Audit of Data Quality
A-E	Air and Energy National Program
AESMD	Atmospheric & Environmental Systems Modeling Division
AMCD	Air Methods & Characterization Division
ANP	Advanced notification products
CCV	Continuing calibration verification
CEMM	Center for Environmental Measurement & Modeling
CESER	Center for Environmental Solutions & Emergency Response
CIMS	Chemical Ionization Mass Spectrometry
CoC	Chain of Custody
CSB	Combustion Source Branch
DQI	Data Quality Indicators
EI	Electron Ionization
EPA	U.S. Environmental Protection Agency
FTIR	Fourier-Transform Infrared Spectrometry
GC-AED	Gas Chromatograph with Atomic Emission Detector
GC/MS	Gas Chromatography/Mass Spectrometry
HASP	Health and Safety Plan
HSMMD	Homeland Security & Materials Management Division
IB	Instrument blank
ICAL	Initial calibration
IO	Immediate Office
LLOQ	Lower Limit of Quantitation
LRB	Laboratory Research Notebook
MSD	Mass Selective Detector
MSDS	Materials Safety Data Sheet
NIST	National Institute of Standards and Technology
NPD	National Program Director
ORD	Office of Research and Development
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substance
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonic Acid
PI	Principal Investigator
PPM	Policies and Procedures Manual
PTFE	Polytetrafluorethylene
PTRMS	Proton Transfer Reaction Mass Spectrometer
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QARF	Quality Assurance Review Form
QC	Quality Control
QMP	Quality Management Plan
RAP	Research Action Plan
RH	Relative humidity
RT	Retention time
SIM	Selective ion mode
SOP	Standard Operating Procedure

SSCV	Second source calibration verification
STMMB	Systems Tools & Materials Management Branch
SVOCs	Semi-Volatile Organic Compounds
TD-GC/MS	Thermal Desorption-Gas Chromatograph/Mass Spectrometer
TLP	Technical Lead Person
TOF	Time-of-flight
TSA	Technical Systems Audit
VOC	Volatile organic compounds

Section A. Project Management

A1. Title and Approvals

See cover page.

A2. Table of Contents

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A3. Distribution List

Name	Organization	Title	E-Mail
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Those listed above will receive copies of this signed/approved QAPP from the EPA TLP. This distribution list includes both project personnel and other ORD personnel with various interests and responsibilities for ORD's PFAS-related research. Those with specific project responsibilities covered by the scope of this QAPP are listed in Section A4 along with their roles and responsibilities.

A4. Project/Task Organization

The personnel involved in carrying out the project objectives and their roles and responsibilities are described below. All work involving PFAS within EPA is currently considered an advanced notification product and must therefore adhere to ORD QA Category A requirements and also follow the reporting structure shown in Figure 1.

Project Personnel	Role	Responsibility
Bill Linak	AMCD Principal Investigator/TLP	Overall project development and management; Technical advisor
Chun-Wai Lee	AMCD Advisor	Technical advisor
Jeff Ryan	AMCD Advisor	Technical advisor
Lindsay Wickersham	AMCD Physical Scientist	Operation and calibration of reactor; data reporting, and review
Stephen Jackson	AMCD Chemist	Non-targeted analysis (GC and LC) & data reporting/review
Theran Riedel	AMCD Chemist	Real-time analysis of alcohols and other polar PFAS (CIM) & data reporting/review
Erin Shields	AMCD Post Doc	Analytical analyses & data reporting/review
Ariel Wallace	AMCD Chemist	Targeted analysis (GC/MS) & data reporting/review
Joshua Varga	Jacobs Contractor	Technical/Engineering Advisor; Provides support with reactor construct, maintenance, and materials
Libby Nessley	AMCD QA Manager	Advises on QA requirements, reviews and approves project QAPP and associated SOPs, performs required assessments for Category A projects
Rebecca Dodder	Supervisor	Project oversight and supervision

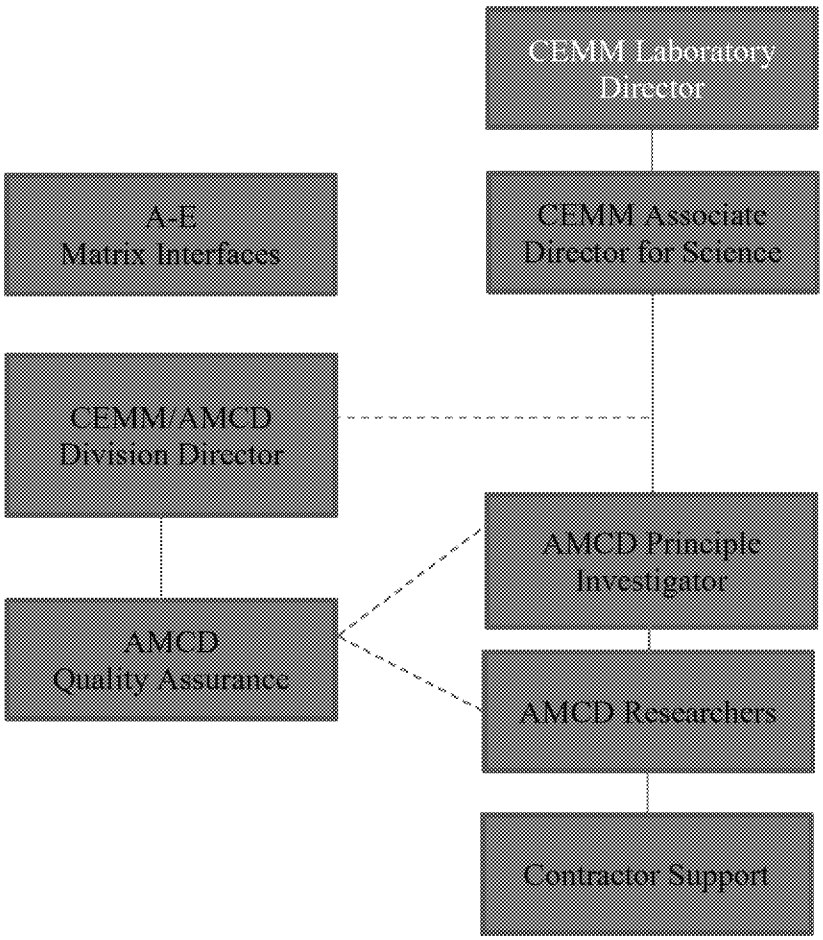


Figure 1. ANP Lines of Approval

A5. Problem Definition/Background

Per- and polyfluoroalkyl substances (PFAS) containing dispersions are applied to fibers, fabrics, and other materials to impart desired hydrophobic and lipophobic properties. These dispersions contain PTFE (Polytetrafluorethylene) powders suspended in aqueous solutions with PFAS surfactants and additives. Fabrics or other materials are immersed/dipped into these aqueous dispersions and then heated in furnaces to dry, bake, and sinter the polymer onto the materials. The purpose of the PFAS surfactants and additives are to maintain the PTFE particles in suspension and promote uniform coverage of the particles on the dipped materials. During thermal processing, at temperatures increasing from 100°C up to 350-400°C, water, PFAS surfactants, and other stabilizing additives are transferred from the liquid to the vapor phase, and the PTFE particles are melted to bind to the fabric (Weston Solutions INC, 2016). Depending on the temperature and polymer, portions of the PTFE may also be degraded and vaporized. PFAS application processes vary in scale and complexity and produce air emissions that are not often controlled. Post furnace, temperature and vapor pressure considerations may promote water and surfactant condensation and the formation of submicron particles. These may deposit on internal duct surfaces or be emitted as fine particles. The result is a mixture of vapor and liquid phase PFAS emissions that may or may not be related to the compositions of the original dispersions. GenX, a trade name for the ammonium form of perfluoro-2-porpoxypropanoic acid, is a fluorinated polymer processing aid used by polymer manufacturers and present in the dispersions used by the fabric coating industry, for example, is believed to decarboxylate to a decomposition product,

heptafluoropropyl 1,2,2,2-tetrafluoroethyl ether (E1) at temperatures as low as 90°C. Once emitted, water solubility, deposition, and surface tension properties may promote PFAS mobility to local soils and groundwater.

This research provides in-house efforts to produce PFAS emissions and PFAS degradation products from fabric coating and thermal application processes using a bench-scale reactor. Variable simulations of commercial application processes will be produced to examine the effect of dispersion type and process conditions (temperatures, flows, residence times, etc.) on air emissions and degradation species.

This facility will be used as a platform for fellow ORD scientists to analyze and characterize PFAS emissions with various analytical techniques for method development and ultimately use this data to inform Agency and state regulators about air emissions from these fabric/yarn tower thermal application processes. The facility also provides a platform for the development of PFAS measurement methods and technology. Following a characterization phase, the facility could also be used for the development of thermal and catalytic mitigation options through the addition of bench-scale direct- or indirect-fired thermal oxidizers or inorganic catalyst technologies being investigated as a separate project. Results generated using this facility will also likely be drafted into manuscripts for publication in peer-reviewed scientific journals.

A6. Project/Task Description

EPA personnel will run fabric/yarn through PFAS containing dispersions in to a vertical three furnace system to simulate industrial fabric coating and emissions. To this end, a 1.7 m, three zone, fabric/yarn tower simulator has been constructed. This simulator is constructed using three electrically heated tube furnaces (13.97 cm ID by 33.53 cm long) arranged vertically in series (0-1010° C, Sola Basic, Type 55035, Watertown, WI). A diagram of the experimental apparatus is presented below (Figure 2). Temperatures within each furnace can be adjusted independently to simulate drying (~100 C), baking (~165-190 C), and sintering (~360-400 C) zones. This is comparable to full-scale industry practices (Weston Solutions INC, 2016). Three 22/25 mm ID/OD by 45.7 cm long quartz tubes with socket end adapters (35/25 mm) are supported by tube clamps within the furnaces. The quartz tubes are connected between furnaces using two 22/25 mm ID/OD by 7.6 cm long quartz crosses with ball end adapters (35/25 mm). A third quartz cross is connected above the sintering furnace. All open cross ends are either covered by 35/25 quartz socket endcaps or caps with 0.32 cm access ports, and all quartz to quartz connections are secured by size 35 stainless steel pinch clamps. The 0.32 cm access ports provide locations for temperature (type K thermocouple) measurements and vapor phase sample extraction after each furnace. The quartz cross sections are wrapped in self-limiting heating tape (0-900° C, Thermolyne, Standard Insulated Samox, Dubuque, IA) and wrapped in alumina insulation to minimize heat loss.

String is used to simulate fabric. From a roll, the string is pulled over guides and pullies, dipped in a PTFE dispersion solution and pulled through an adjustable size metering die at the bottom of the first furnace and up through the center of the quartz tubes. After the third furnace, at the top of the quartz assembly, the string passes vertically through a 0.32 cm access port, and through a pinch roller controlled by a variable speed motor. Vaporized water, induced air drawn in through the open quartz tube at the bottom of the first furnace, and other vapor phase emissions from the PTFE dispersion are directed horizontally through a fourth cross assembly (for additional sample access), through a quartz to stainless steel tube transition, and to a small diaphragm pump (0-30 L/min, Thomas, 107CAB14TFEL, Sheboygan, WI). From the pump, the gases pass through a rotameter and are vented.

The experimental system is designed to allow the independent control of the string speed and residence time, drying, baking, and sintering zone temperatures, and vapor flow and residence time. To simulate industry, initial calculations indicate that a 9 L/min air flow, 110 cm/min string speed, and zone temperatures of 100, 165, and 360 °C, results in a 2.7 sec gas residence time and 1.5 min fiber residence time (Weston Solutions INC, 2016).

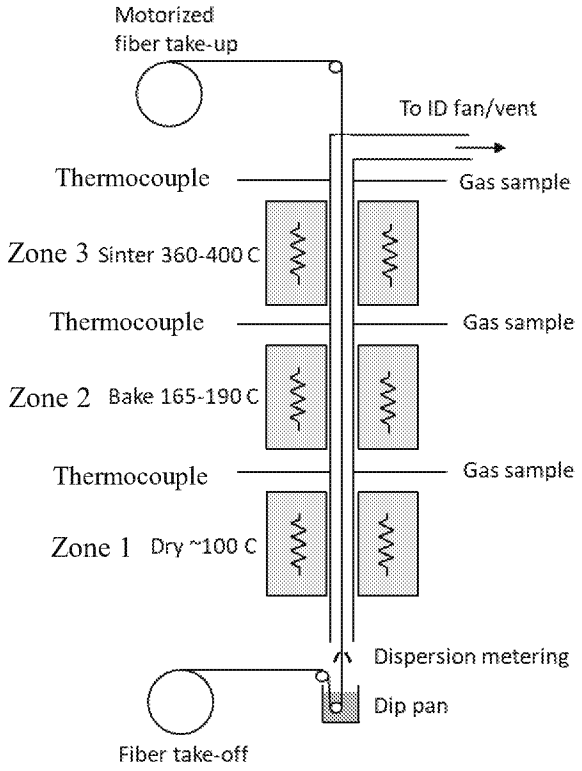


Figure 2. Schematic and Layout of String Reactor

A7. Quality Objectives

This facility allows for full control of flows, times, temperatures, residence times, and application rates of PFAS compounds to fabric. This will act as a platform for measurement methods development and explore research questions including but not limited to:

- What PFAS and additives are present in different commercial dispersions?
- What PFAS (and other species) are vaporized during application processes?
  - Is a fluorine mass balance possible?
  - What fraction of organic fluorine is released as vapor emissions?
- How do vapor phase PFAS emissions compare to dispersion compositions?
  - Are surfactants (GenX, telomer alcohols, etc.) included in the vapor emissions?
- Are processing temperatures sufficient to transform PFAS
  - Cleave functional groups to produce new PFAS?
  - Does this result in higher molecular weight PFAS?
  - Is this the source of fine PM formation?
- Are processing temperatures sufficient to cleave Carbon-Fluorine bonds and produce fluorine and hydrogen fluoride?
- How do processing temperatures and times affect vapor and aerosol emissions (mass and composition)?

Because this project is predominantly methods development, many of the questions posed here have yet to be investigated. This QAPP is intended to be a living document and as processes are determined, a version will be updated and saved in track changes until revisions are formally incorporated into the approved/signed QAPP and returned to the EPA QAM for review/approval on at least an annual basis. The track changes version of the QAPP will be housed in the electronic notebook kept for this project so progress and revisions are documented and available.

A8. Special Training/Certification

No specific training is required for this project, but the analysts shall have completed all site-specific health and safety training requirements that are applicable and be competent in the operations of the analytical instrumentation being used. Records of this training are maintained by the EPA SHEM office or by individual researchers, respectively. This document assumes laboratory personnel will have a thorough working knowledge of basic laboratory skills, reagents, and instrumentation. Any standard operating procedures (SOPs) utilized are designed to guide a competent laboratory worker in the analysis of per- and polyfluorinated compounds and it is not intended to instruct individuals on the basic aspects of analytical chemistry.

A9. Documents and Records

Research activities must be documented according to the requirements of ORD PPMs 13.2, 13.4, and 13.6, as well as requirements defined in the task specific QAPPs. These policies require the use of research notebooks and the management of research records, both paper and electronic, such that project research data generation may continue even if a researcher or an analyst participating in the project leaves the project staff. Signature approved electronic copies of this QAPP, SOPs, and any associated audit reports, will be maintained in the ORD QA Track database to ensure data backup. The TLP will be responsible for ensuring distribution of the current version of the QAPP, timely communications with all involved participants, and will retain copies of all management reports, memoranda, and correspondence between research task personnel. All study information will be recorded and tracked in a dedicated study file located on a ShareDrive. This is located on the L:Drive and will be maintained with the most up to date records and information regarding the string reactor. It can be found here: L:\Lab\NRML_Public\PFAS\String Reactor

Records will be maintained in accordance with EPA policy for records retention. Periodic reviews of notebooks are recommended, and in accordance with PPM 13.2 these notebook reviews may be conducted by the PI, supervisors, and peers. The QAM may also conduct formal notebook reviews as part of the planned assessments for a specific research area. Electronic Records shall be maintained in a manner that maximizes the confidentiality, accessibility, and integrity of the data. ORD PPM Section 13.6 provides guidance on the maintenance of electronic records for ORD. This research has been also been issued and approved to use an electronic notebook to maintain the most current version of the QAPP and other project records which will also be kept in the L: Drive ShareFolder. This will be used by operators of the string reactor to document pertinent experimental details and parameters used to generate emissions. All SOPs and QAPPs used in subsequent analyses will be referenced. Approved QAPP and SOP additions and revisions will be done as methods are developed and be documented in a track changes version of the signed/approved document. The QAPP will be updated at least annually to incorporate these revisions.

Section B. Data Generation and Acquisition

B1 Sampling Process Design (Experimental Design)

The technical approach will be to conduct emissions testing using multiple emissions sampling approaches while the string reactor is simulating industrial application practices with PFAS containing dispersions. Emission samples will be drawn through the sampling ports located in between and after the three furnaces. Sampling methodology of each analytical method will be followed as documented in SOPs and QAPPs.

The string reactor consists of three 25 mm quartz tubes that are 45.72 cm long. These are surrounded by three electric furnaces that can be altered independently of each other to create "zones." Zones are connected by 3 25 mm quart crosses that are 10.16 cm in length. These connectors are surrounded by heat tape that can adjust to match the temperature of the "zone" before it. These connector areas contain a thermocouple to monitor gas temperature inside the tube as well as a sampling port to pull samples of the heated gas

surrounding the PFAS coated string (Figure 2).

The string used for experiments will be composed of different materials and will vary in width between types. Pertinent details about each spool of string used, including the source from which the string was purchased, its width, and composition will be documented in the laboratory notebook. Each spool will be given a unique ID based on the width of the string, the composition, and the order of its purchase. For example, the first spool of 3 mm cotton twine ordered would have a unique ID of 3C_A (3=3mm, C=Cotton, A=first spool of its kind ordered). A key will be updated in the laboratory notebook for clarity.

The string will be pulled through a dispersion dip pan containing a PFAS dispersion or dispersion component. The dip pan will consist of a beaker that can be raised or lowered to submerge the string. The dispersions will be purchased from online sellers or collected from industry settings. Compositions of these dispersions or dispersion components will be documented in the laboratory notebook to the best of the ability of the scientist with the understanding that some of this information may not be available as it is confidential business information. All material safety data sheets and other available information regarding dispersion's composition will be documented in the laboratory notebook. As in industry, excess dispersion liquid will be removed from the string using a metering die of variable width before the string enters the quartz tubing for processing. The width of the metering die will be documented for each experiment along with pre and post processing weight of the dispersion dip pan to monitor application rates.

Room air will be pulled through the string reactor using a Thomas pump attached after zone 3 (Figure 2) and will be exhausted into the vent system. The rate at which the air is being pulled will be monitored by a rotameter and will be documented for each experiment. Gas will travel upwards through the string reactor zones and be heated by the different furnaces before exiting into an exhaust vent. Gas samples will be collected at the connection crosses located between zones. Air temperature of these gas samples will be monitored with thermocouples at the opposite end of the cross.

B2 Sampling Methods

Sampling methods will vary based on the methods chosen to analyze the samples. A standard form will be used to consistently record experimental parameters every time a reactor test is performed. Completed forms will be stored in a 3-ring binder and scanned into the OneNote Laboratory notebook. A copy of this form is attached as Appendix 1.

All sampling methods will be informed by the SOP and/or the expertise of the analyst for the analytical instrument (Section *B4 analytical methods*). Anticipated instrumentation is listed here, but we note that measurement techniques may be added or removed as the experiments progress. In the event such measurements are added, appropriate additions will be made to this QAPP after approval from the CEMM QA team.

Chemical Ionization Mass Spectrometer (CIMS). A direct sampling instrument for analysis of gas-phase chemical compounds. Using iodide (I-) reagent ion chemistry, the CIMS can detect polar PFAS compounds such as those with alcohol or carboxylic acid functional groups.

The following instrumentation is either in the purchase or development process and will, in some combination, likely be used during the planned experiments. Appropriate QA documentation will be added as these techniques become available and are used.

Proton Transfer Reaction Mass Spectrometer (PTRMS). An instrument similar to the CIMS with the same direct air sampling capabilities for analysis of gas-phase chemical compounds. Hydronium (H3O+) ions are used as the reagent ion enabling detection of a range of reduced compounds compared to the oxidized compounds detected by the iodide CIMS.

*Thermal Desorption-Gas Chromatograph/Mass Spectrometer (*TD-GC/MS). An instrument for analysis of sorbent tubes, which capture volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) during gas-phase sampling. Sorbent tubes are heated under helium gas flow to desorb compounds and capture them onto the secondary cold trap, which is then rapidly heated to send the sample to the GC column for chromatographic separation and electron ionization (EI) mass spectrometry. This technique can be used to detect volatile PFAS compounds in the range of C2/3-C30 when sampling with three-bed Universal sorbent tubes (Markes International). Other types of sorbent tubes may also be utilized for PFAS sampling as method development progresses.

Fourier Transform Infrared Spectroscopy (FTIR).

Gas Chromatograph/Mass Spectrometer (GC/MS).

Gas Chromatograph with Atomic Emission Detector (GC-AED).

All techniques above are considered online measurements which generate real-time data and do not require collection of a sample for analysis. All sampling procedures and modifications utilized will be documented in the research notebook and experimental conditions forms (Appendix 1) associated with this QAPP.

B3 Sample Handling and Custody

All specific sample handling will be informed by the SOP for the analytical instrument that will use the sample (*Section B4 analytical methods*).

All samples collected should be labeled with the following information upon collection:

Sample number (Method abbreviation #XXX – for example, MM5#007)
Date and time of collection
Collector name
Collector notes (optional; any additional information - can also be sent via email)

B4 Analytical Methods

This facility is a tool meant to help ORD develop analytical methods and approaches that are currently more conceptual in nature than established methods. As such, procedures will be subject to changes, modifications and alternatives as identified. As a result, the existence of formal documented procedures is limited or in some cases non-existent at this time. This QAPP intends to capture the general approach and framework for generating gas emissions in the string reactor that can be available for analytical tests. Table 1 will be updated with the procedures used to analyze these gas emissions as they are performed. This list will continue to be updated as new methodologies are introduced.

Table 1. Analytical methods applied to gas emissions generated by the string reactor

Instrument Description or Method Name	Title	QAPP or SOP Reference #
Negative Mode Chemical Ionization Mass Spectrometry (CIMS)	"Operation of the Aerodyne/Tofwerk Chemical Ionization Mass Spectrometer"	D-EMMD-AQB-013-SOP-02

Instrument Description or Method Name	Title	QAPP or SOP Reference #

B5 Quality Control

The individual components of the string reactor (thermocouples, mass flow controllers) can be calibrated and controlled to a degree well above the ability to precisely control the experimental conditions to generate repeatable gas emissions. Data Quality Indicator (DQI) goals for critical measurements are established with the goal of reliably repeating experimental conditions for gas emission creation. All critical measurements and their DQI goals are detailed in Table 2 below.

Quality control criteria for specific analytical methodologies are discussed in appropriate detail in the instrument specific QAPPs and SOPs referenced in Section B4 Table 1.

Table 2: Critical Measurements and DQI goals

Critical Measurement	Monitoring & Measurement Equipment	Range	DQI Goal
Exhaust Flow Rate	Flow speed will be controlled by a Thomas pump and be measured at the exhaust with a Rotameter. The measured flow speed will be corrected to standard conditions using temperature.	0-25 L/min	±10% of desired flow rate
Post Furnace Gas Temperature	Temperature of the post furnace gas will be monitored with thermocouples after each furnace "zone".	20°C -600°C	±15% of desired temperature.
String Speed	String speed will be determined by timing a marked section of the string through the length of the facility three times and averaging the results for each setting controlling the motor. Analyst will create a calibration curve based on settings of controller and observed string speed. This will be repeated for each different type of string used. Before each experiment, the speed will be checked one time to ensure it falls within the bounds of the calibration curve.	0-200 cm/min	±15% of desired string speed

Non-Critical measurements that will be monitored for informational purposes include:

- Dispersion Application Rate
  - We will monitor dispersion application rate by weighing the dispersion before and after an experiment as a function of time. Scale will be certified with accuracy within 1 gram by certified weights every 3 months.
- Furnace and Heat Tape Temperatures
  - Heat Tape temperatures will be monitored and regulated by controllers. This will influence Post Furnace gas temperatures.
  - Furnace temperatures displayed on the furnace will be checked with a thermocouple to determine level of accuracy. This reading will influence post furnace gas temperature.

B6 Instrument/Equipment Testing, Inspection, and Maintenance

All thermocouples and mass flow controllers will be independently tested and calibrated by the Meteorology Lab at EPA, RTP prior to the generation of publishable data.

The motor controlling string speed will be inspected before each experiment for precision. A set speed with a previously documented string speed will be reanalyzed with a marked string and a stopwatch. If this speed is within 15% of the previously calculated string speed, it will be assumed that the string speed measurement is reliable. If it fails to fall within 15% of the most recently calculated values, a new calibration curve will be created for all settings on the controller. Calibration curves will be created for every different type of string used.

The scale used to determine dispersion application rate will be certified for accuracy within 1 gram every three months using certified weights. These checks will be documented in the laboratory research notebook.

Sampling Blanks will be collected with each analysis to highlight any potential contamination of the string reactor. This is defined as an air sample taken while non-dipped string moves through the reactor and before the experiment begins. All other experimental parameters for the sampling blank should be representative of the experiment to follow (i.e. furnace temperatures, string speed, etc.). Appropriate measures will be applied to reduce and attempt to eliminate contamination if found.

B7 Instrument/Equipment Calibration and Frequency

Thermocouples and rotameters will be independently calibrated prior to generation of publishable data by the Meteorology Lab at EPA, RTP. For analysis of gas samples, instrument calibrations and conversion to mixing ratios or concentrations will follow the instrument specific QAPPs and SOPs.

A calibration curve for string speed will be recreated if necessary. This will be determined by checking of string speed as outlined Section B5 Table 2: Critical Measurements and DQI goals. If a calibration check is not within the 15% criteria, a new calibration will be performed.

B8 Inspection/Acceptance of Supplies and Consumables

The quality of purchased materials (e.g., reagents, standards, instrumentation, and equipment) used in the laboratory are specified in the SOPs and protocols. The laboratory purchases reagents with purity requirements that are established within the appropriate SOPs. Compressed gases used in research activities will be procured to the specification defined in the technical SOPs.

B9 Non-Direct Measurements

No secondary or existing data will be used in generating gas emissions from the string reactor. As such this section is not applicable.

B10 Data Management

AMCD will follow the procedures outlined in NRMRL's Programmatic QAPP for PFAS research (QA Track # K-IO-0031626-QP-1-6) The data files are the electronic versions of these data generated by the analytical instrumentation. The electronic version of data is calculated by the instrument software and then exported to Excel. The file path(s) for where electronic data is stored will be documented in the OneNote electronic laboratory notebook. Raw data (including electronic data on individual PC hard drives and group shared drives) will be backed up to a network or external hard drive. All data generated will be maintained by the PI, Bill Linak, until completion of the project. Upon completion, data will be stored in accordance with EPA's record management policy. All instrument data will be backed up to network drives routinely and will be archived along with other supporting data and relative correspondence at the completion of the study. Printed data will be scanned and inserted into OneNote and signed and dated in accordance with the ORD's PPM 13.02 on Paper Laboratory Records. The OneNote electronic notebook or the hardbound notebook dedicated to the analytical instrument used will be the record for any procedure conducted in the laboratory and will provide the objective, procedure details, data references and discussion for project development. Data will be recorded from these experiments as observed. Any standard, solution, or sample made during these investigations will be marked with a reference number and/or will be traceable to a specific entry in the OneNote electronic notebook.

Section C. Assessment and Oversight

C1 Assessments and Response Actions

Category A research projects are required to have a Technical System Audit (TSA) and an Audit of Data Quality (ADQ) for each critical dataset completed at least once during the project to determine that systems and procedures for sampling and data collection are implemented as defined in this QAPP. These audits will be performed by the AMCD QA Manager and coordinated with the AMCD Principal Investigator.

C2 Reports to Management

QA assessments will be documented in a report to the principal investigator. The report will include deficiencies identified as findings and/or observations. Findings require corrective actions.

TSAs and data quality audit results will be reported to and reviewed by the Principal Investigator and their supervisor (Branch Chief). The AMCD QAM will identify to the project or task lead any corrective action that requires immediate action as an assessment is conducted. If deficiencies are identified that may negatively impact the ability to achieve project objectives, the QAM will advise the project or task lead and may recommend that a stop work order be issued to ensure that a corrective is identified and implemented.

The project or task lead will ensure that a response is provided for each deficiency or observation and will implement any necessary corrective action. The QAM will verify that corrective action has been implemented and is effective. Assessment reports are preserved by the Principal Investigator as part of the project record.

Given the visibility of this project, it is anticipated there will be regular updates to management on the status of the project. These updates will be informal meeting discussions to help facilitate the overall progress of the research being done.

Section D: Data Validation and Usability

D1 Data Review, Verification, and Validation

Analytical data will be summarized or analyzed according to the requirements of the respective technical SOP or task specific QAPP for each methodology used. Methodologies used for analysis will be updated in Section B4 Table 1 as implemented.

All data produced will be examined routinely by the technical project personnel. The first level of review will be conducted by the primary analyst(s). Upon generation of semi-finalized data (calibrations, conversion of signals to mixing ratios or concentrations, destruction/remove efficiencies, figures/tables for publication), another member of the project team or QA staff will review presented data for consistency and quality. Secondary reviews will be documented directly on electronic spreadsheets or in hardbound notebooks with name/initialed signature of the reviewer and the date reviewed.

D2 Data Quality Audits

Consistent with the requirements of Section 2.2.3.2 of the ORD QMP, Data Quality Audits will be conducted for those projects for which formal data quality objectives were developed. As stated in Section 2.2.3.2 of the ORD's QMP Data Quality Audits are conducted by the project or task lead. The lead will trace the data from initial acquisition, through reduction and statistical comparisons, to final reporting. All calculations performed on the data undergoing the audit will be verified.

D3 Reconciliation with User Requirements

The project or task lead will review the reported data to verify that QC checks have been documented as described in the project QAPP, and that acceptance criteria have been met and that data has been qualified appropriately using qualifiers as identified.

The technical lead shall use the results of the data review, verification, and validation process to assess whether the data quality meets the project requirements and thereby the user requirements. If there are data quality issues that may impact their use, the impact will be evaluated by the technical lead. The technical lead may seek assistance from QA staff as needed.

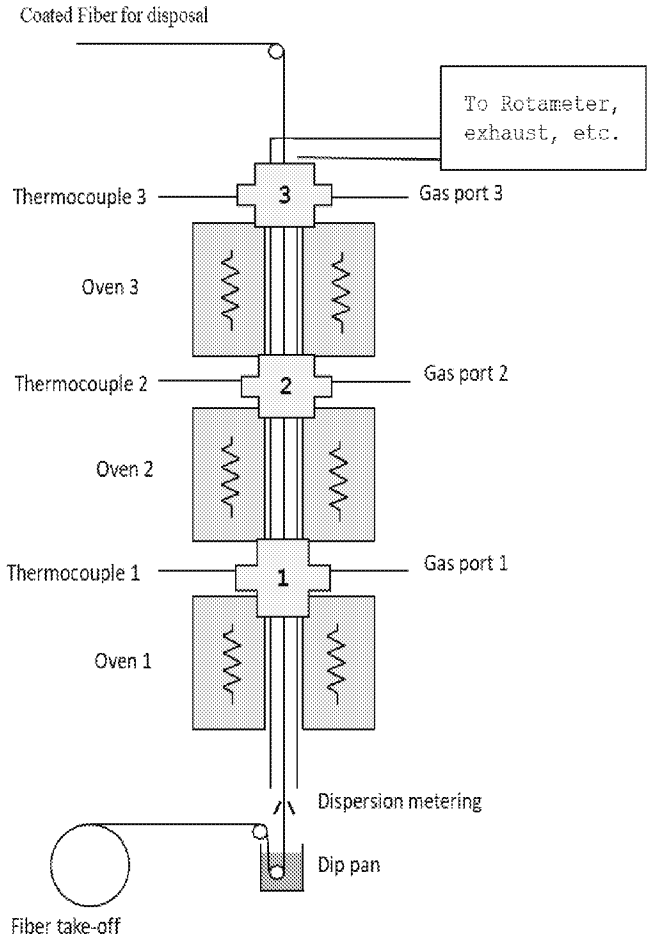
References

Weston Solutions INC (2016). *Perfluorinated Sulfonic Acids and Perfluorinated Carboxylic Acids Testing Program Report: Saint-Gobain Performance Plastics Merrimack, New Hampshire.* Report prepared for the New Hampshire Department of Environmental Services. Concord, NH. Retrieved from: https://www4.des.state.nh.us/IISProxy/IISProxy.dll?ContentId=4688374.

Appendix 1. String Reactor Operation Form

Date: _____ Operator: _____

Temperature Details:



Heat Tape= ☐

What	Setting/reading (°C)	Target (°C)
Oven 1		
Oven 2		
Oven 3		
Thermocouple 1		
Thermocouple 2		
Thermocouple 3		
Heat Tape 1		
Heat Tape 2		
Heat Tape 3		
Rotameter thermocouple		

Application Details:

String ID: _____ Metering Dye: _____ Dispersion ID/description:_____

Rotameter: _____L/min Controller setting: _____% Timed String _____ ☐ QC goal met

Time run started: _____ Pre-application weight of dispersion: _____

Time run stopped: _____ Post-application weight of dispersion: _____

Sampling details:

Ports sampled: 1 2 3 other Duration of sampling:

Intended Analytical Method and pertinent details:

Other Notes: